VELS

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI
NAAC ACCREDITED WITH 'A' GRADE
Marching Beyond 25 Years Successfully

M.Sc
Biochemistry

Curriculum and Syllabus

Effective from the Academic year
2018 - 2019

Department of Biochemistry
School of Life Sciences

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1. Compare and contrast the scope and profundity of scientific knowledge in the broad range of fields, including Cell biology, Intermediary metabolism, Clinical Biochemistry, Hormonal Biochemistry, Genetics, Nutritional Biochemistry, Immunology and Enzymology.

PEO2. An ability to gain knowledge and know-how for successful career in academia, industry and research.

PEO3: Describe the biochemical basis of human diseases, protein structure and conformation, non-invasive diagnostics, biochemical pathway regulation and drug development and apply the same for a multitude of laboratory applications.

PEO4: Promoting lifelong learning to meet the ever-evolving professional demands by developing ethical, inter personal and team skills.

PROGRAM OUTCOME (PO)

The M.Sc. programme (Biochemistry/Biotechnology/Bioinformatics/microbiology) at VISTAS has documented measurable outcomes that are based on the needs of the programme's stakeholders. The programme outcomes that the department presently adapts to are as follows:

PO-1 Life Sciences knowledge: Successful candidates will acquire current/recent specific knowledge in the respective discipline with proficiency in practical skills and leadership skills for a successful career.

PO-2 Problem analysis: Successful candidates will be able to analyse, design standards, resolve and troubleshoot problems in implementation or standardization of Life sciences protocols.

PO-3 Design/development of solutions: Successful candidates will develop creative and cognitive thinking and cooperate with each other to solve problems in the field of Life sciences.

PROGRAMME SPECIFIC OUTCOME (PSO)

PSO1: Demonstrate an understanding of structure and metabolism of macromolecules and understand the regulation and disorders of metabolic pathways.

PSO2: Gain proficiency in laboratory techniques in both biochemistry and molecular biology, and be able to apply the scientific method to the processes of experimentation and Hypothesis testing.

BOARD OF STUDIES

S. No	NAME	AFFILIATION	ROLE
1	Dr V. Vanitha	Associate Professor and Head, Department of Biochemistry, School of Life Sciences, VISTAS	Chair Person
2	Dr. A. Geetha	Principal, Hosur Government Arts and Science college Hosur	External expert
3	Dr. Arivazhagan	Associate Professor and Head, Department of Clinical Biochemistry, Cancer Institute, Adyar, Chennai 600020	External expert
4	Dr. K. G. Kripa	Associate Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Internal Member
5	Dr. R. Sangeetha	Associate Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Internal Member
6	Dr. K. Gayathri	Assistant Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Internal Member
7	Dr. R. Padmini	Assistant Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Internal Member
8	Ms. P. Surya	Application Specialist, CPC Diagnostics, Gopalapuram	Alumni, MSc Advanced Biochemistry (2010-2012 batch)

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES

(VISTAS)

M.SC BIOCHEMISTRY

COURSES OF STUDY AND SCHEME OF ASSESSMENT

(TOTAL NO OF CREDITS: 90)

CATEGORY	CODE	TITLE OF THE PAPER	Hours / Week			CREDITS	Maximum Marks		
			L	T	P		CA	SEE	Total
SEMESTER I									
CORE	15MBC001	Chemistry of Biomolecules	5	-	-	4	40	60	100
CORE	15MBC002	Advanced Instrumental Techniques	5	-	-	4	40	60	100
CORE	15MBC003	Practical I Biochemistry & Instrumentation Lab	-	-	10	3	40	60	100
DSE		Discipline Specific Elective 1	4	-	-	4	40	60	100
DSE		Discipline Specific Elective 2	4	-	-	4	40	60	100
GE		Generic Elective 1	2	-	-	2	40	60	100
		Total	20	-	10	21			
SEMESTER II									
CORE	15MBC004	Enzymology	5	-	-	4	40	60	100
CORE	15MBC005	Intermediary metabolism	5	-	-	4	40	60	100
CORE	15MBC006	Practical II Biotechnology Lab	-	-	4	3	40	60	100
CORE	15MBC007	Practical III Microbiology Lab	-	-	4	3	40	60	100
DSE		Discipline Specific Elective 3	4	-	-	4	40	60	100
DSE		Discipline Specific Elective 4	4	-	-	4	40	60	100
GE		Generic Elective 2	2	-	-	2	40	60	100
GE		Generic Elective 3	2	-	-	2	40	60	100
		Total	22	-	8	26			
SEMESTER III									
CORE	15MBC008	Genetics and Molecular Biology	5	-	-	4	40	60	100
CORE	15MBC009	Clinical biochemistry	5	-	-	4	40	60	100
CORE	15MBC010	Practical III Clinical Biochemistry Lab	-	-	10	3	40	60	100
DSE		Discipline Specific Elective 5	4	-	-	4	40	60	100
DSE		Discipline Specific Elective 6	4	-	-	4	40	60	100
GE		Generic Elective 4	2	-	-	2	40	60	100
CORE		Internship	-	-	-	2	40	60	100
		Total	20	-	10	23			
SEMESTER IV									
CORE	15MBC011	Toxicology and Forensic Biochemistry	4	-	-	4	40	60	100
CORE	15MBC012	Project	26	-	-	16	40	60	100
		Total	30	-	-	20			
		TOTAL CREDITS							**90**

List of Discipline Specific Electives

1. 15MBC101 Human Physiology and Basics of Anatomy
2. 15MBC102 Cell Biology
3. 15MBC103 Fundamentals of Computers, Biostatistics and Research Methodology
4. 15MBC104 Phytochemistry, Pharmacognosy & Quality Control
5. 15MBC105 Microbiology and Immunology
6. 15MBC106 Biotechnology and IPR
7. 15MBC107 Modern Lifestyle Associated Diseases
8. 15MBC108 Neurobiology
9. 15MBC109 Endocrinology
10. 15MBC110 Plant Biochemistry
11. 15MBC111 Biochemical Toxicology
12. 15MBC112 Molecular Developmental Biology
13. 15MBC113 Nanotechnology
14. 15MBC114 Stem cell technology
15. 15MBC115 Cancer Biochemistry
16. 15MBC116 Biochemistry of cell signaling
17. 15MBC117 Environmental Science

List of Generic Electives

1. 15MBC151 Communicative English I
2. 15MBC152 Communicative English II
3. 15MBC153 Bioinformatics
4. 15MBC154 Pathological Basis of Diseases
5. 15MBC155 Medicinal Botany
6. 15MBC156 Biomaterials

SYLLABUS

CORE COURSES

15MBC001 CHEMISTRY OF BIOMOLECULES 5 0 0 4

Course objectives

The objective is to study about the structure and biological functions of macromolecules such as proteins, polysaccharides, lipids, and nucleic acids, as well as small molecules such as primary metabolites, secondary metabolites, and natural products.

Unit 1 Carbohydrates (12)

Carbohydrates: Classification of Carbohydrates. Structure and functions of Monosaccharides, Disaccharides and Polysaccharides. Structure and biological importance of sugar derivatives, Glycosaminoglycans, Proteoglycans, Glycoproteins and Lipopolysaccharides.

Unit 2 Proteins (12)

Classification, structure and properties of amino acids and proteins. Structural organisation of proteins – Primary structure and its determination, Secondary and Super secondary structures, Tertiary and Quarternary Structure. Peptide Synthesis. Isolation and purification of proteins.

Unit 3 Lipids (12)

Lipids- Classification, structure and functions of fatty acids, alcohols and lipids. Physical and chemical properties of fatty acids. Structure and function of Eicosanoids, Lipoproteins-classes, transport and functions. Steroids.

Unit 4 Nucleic acids (12)

Structure of nucleosides, nucleotides. DNA double helical structure. A, B and Z forms of DNA. Triple and quadruple structure. DNA super coiling and linking number. Properties of DNA – buoyant density, viscosity, hypochromicity, denaturation, renaturation, Cot curve. Chemical synthesis of oligonucleotides. DNA sequencing. Major classes of RNA, their structure and biological role.

Unit 5 Nanoparticles (12)

Definition of a nanosystem, Basic concepts of nanoscience and technology. Time and length scale in structures. Overview on nanomaterials. Protein nanoparticles. Biological nanostructures, Novel delivery routes using nanoparticles with special reference to drug delivery process.

Total : 60 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Easily understand the basic concepts/functions of solutes, chemical bonding and organic compounds

CO2: Describe the classification of biomolecules

CO3: Describe the basic reaction types and mechanisms of bio molecules

CO4: Understand the structures and functions of biomolecules

CO5: Analyse and study the chemical and biochemical properties of bio molecules

Text Books

1. J.L.Jain et al. Fundamentals of Biochemistry by S.Chand and Company 4th edition, 1994.
2. M.N.Chatterjea and Ranashinde Text book of Medical biochemistry Jaypee Brothers Medical Publisher (P) Ltd, 6th edition 2005.

Reference Books

1. Lippincott's illustrated biochemistry – Champe and Harvey; 6th edition 2007.
2. D.Voet and J.G. Voet, Biochemistry, John Wiley & Sons, USA 2004.
3. Albert L. Lehninger Principles of Biochemistry CBS Publishers & Distributors, New Delhi, 4th edition 2004.

15MBC002 ADVANCED INSTRUMENTAL TECHNIQUES 5 0 0 4

Course objectives

Advanced instrumental techniques are used to understand the theoretical principles involved in Bioinstrumentation which may be used for the determination of nutrients, major ions and trace elements, biological samples together with the analytical techniques. Some of these techniques are particularly useful for the detailed analysis of recent methodologies used in the chemical analysis of biota as discussed in the chapter.

Unit 1 Microscopy and Cytotechniques (12)

Microscopy - Principles of Microscopy – bright and dark field, fluorescence, phase contrast, scanning and transmission electron microscopy. Cytotechniques – tissue homogenization and Cell disruption, cell counting and sorting, cell culture techniques, preservation of cell and tissues.

Unit 2 Radioactivity and Biosensors (12)

Detection and measurements - GM counter, Scintillation counter. Safety aspects. Biological applications: assessing the metabolic pathways, radio dating, isotope dilution technique, autoradiography. Biosensors - Introduction to Biosensors: Concepts and applications. Biosensors for diabetes management. Noninvasive Biosensors in Clinical Analysis.

Unit 3 Centrifugation and Electrophoresis (12)

Centrifugation: Basic Principles of Centrifugation. Instrumentation and applications of Preparative - Differential and Density Gradient Centrifugation, Analytical Ultracentrifugation – ultra centrifuge, applications. Electrophoresis: Principles and Factors Affecting Electrophoresis. Principle, methodology and applications of PAGE, SDS-PAGE, IEF, 2D PAGE, Agarose Gel Electrophoresis.

Unit 4 Chromatography (12)

Chromatography: Principles, Instrumentation and Applications of Paper Chromatography, TLC, Column Chromatography, LPLC, HPLC, Gel filtration

Chromatography, Ion-Exchange Chromatography, Affinity Chromatography and GLC.

Unit 5 Spectroscopy (12)

Spectroscopy: Basic Principles of Electromagnetic Radiation, Beer-Lambert's Law. Principle, instrumentation, operation and applications of UV-Visible, IR, Spectrofluorimetry, Flame Photometry, AAS, NMR, ESR, X-Ray Diffraction, Mass spectrometry,

Total : 60 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Demonstrate broad knowledge in modern analytical instrumentation with deep knowledge in its core concepts and its applications.

CO2: Understand the principle, Instrumentation of different types of Light microscopy and electron microscopy and its applications in various fields of research.

CO3: Acquire knowledge about the basics and latest developments in the instrumentation techniques of Centrifugation, Electrophoresis (IEF, 2D PAGE) and Chromatography and their applications in various research fields.

CO 4: Demonstrate skills to explain about principle, Bioinstrumentation and applications of latest spectroscopy techniques like Turbidometry, AAS, NMR, ESR and Nephelometry.

CO5: Gain extensive exposure from basic to latest cytotechniques (FISH technology & Biochip technology).

Text Books

1. Keith Wilson and John Walker, Principles and techniques of Practical Biochemistry, 2010, Seventh edition, Cambridge University Press
2. Asokan P, Analytical biochemistry Biochemistry, 2009, Chinna publication.

Reference Books

1. Holme. D. J. and Peck. H., Longman Analytical Biochemistry, 1998, 3rd edition.
2. Chatwal**,** G & Anand**,** S, Instrumental methods of chemical analysis, 2005, Himalaya Publishing Hous**e**
3. S. K. Sawhney & Randhir Singh, Introductory Practical Biochemistry, 2014, Narosa Publications House

15MBC003 PRACTICALS I BIOCHEMISTRY AND INSTRUMENTATION LAB 0 0 8 3

Course objectives

The course aims to develop skills of performing basic biochemical tests important in clinical investigations, to develop familiarity with biochemical laboratory techniques, and to introduce students to various practical aspects of enzymology and their correlation in disease conditions.

List of Experiments

Biochemical Studies

1. Estimation of Tryptophan
2. Estimation of Lactate
3. Estimation of pyruvate
4. Estimation of protein by Bradfords method
5. Isolation and estimation of DNA,
6. Isolation and estimation of RNA
7. Isolation and estimation of glycogen from tissues.

Bioinstrumentation Lab

8. Separation of Aminoacids/ sugars by paper chromatography and TLC
9. Separation of Plant pigments by column chromatography
10. Separation of Proteins by gel filtration chromatography
11. SDS PAGE-Demonstration

Course outcomes

After the completion of this course, the student will be able to

CO1: Learn how to standardise various biomolecules.

CO2: Track various techniques adopted for separation of biomolecules.

CO3: Demonstrate separation of protein by electrophoresis.

CO4: Separate carbohydrates by paper chromatography,

CO5: Separate amino acids by paper and thin layer chromatography.

Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers. 2011 (Paperback).

2. S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009 (paperback).
3. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd. 2 edition, 2005.

Reference Books

1. Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.
2. Hans Bisswanger, Practical Enzymology. Wiley VCH. 2nd Edition, 2011.
3. Robert Eisenthal, Enzyme Assays: A Practical Approach (Practical Approach Series). Oxford University Press, U.S.A. 2 edition, 2002.

15MBC005 ENZYMOLOGY 5 0 0 4

Course objectives

This paper aims to provide a basic understanding of biological catalysis, Mechanism of action of enzymes, structure and function relationship, Understanding the enzyme kinetics and role of co-enzymes/co-factors and an overview of Industrial application of enzymes.

Unit 1 Introduction (12)

General introduction, Nomenclature and classification of enzymes, isolation and purification of enzymes –criteria of purity - specific activity. Enzyme units - Katal, IU. Measurement of enzyme activity - . Active site - determination of active site amino acids - chemical probe, affinity label, and site directed mutagenesis. Investigation of 3-D structure of active site. Isoenzymes.

Unit 2 Kinetics (12)

Kinetics of single substrate enzyme - catalysed reactions - Michaelis – Menten equation, importance of Vmax, Km, MM equation, and turnover number; Lineweaver - Burk plot, Eadie - Hofstee plot, Hanes - Woolf plot . Kinetics of Allosteric enzymes - MWC and KNF models. Hill' equation coefficient. Kinetics of multi – substrate enzyme - catalysed reactions - Ping-pong bi-bi, random order and compulsory order mechanism.

Unit 3 Catalysis and Inhibition (12)

Mechanism of enzyme action - general acid-base catalysis, covalent catalysis, role of metal ion in enzyme catalysis, mechanism of serine proteases - chymotrypsin, lvsozyme, carboxy peptidase A and ribonuclease. Reversible inhibition - competitive, uncompetitive, noncompetitive, mixed, substrate and allosteric inhibition. Irreversible inhibition.

Unit 4 Coenzymes (12)

Coenzymes - prosthetic group and cofactors with examples. Structure, functions and mode of action of TPP (oxidative decarboxylation) , FMN , FAD ,NAD , NADP (redox reactions), PALP and PAMP – (transamination), Coenzyme A (Acylation/acetylation reactions), biotin – (carboxylation), tetrahydro folate (one

carbon transfer), cobalamine coenzymes-cyano, hydroxo, methyl and deoxy adenosyl cobalamine- role in methyl group transfer and mutase reactions. Co-enzymic functions of vitamin C, lipoic acid and coenzyme Q in metabolic reactions .

Unit 5 Applications of enzymes (12)

Industrial uses of enzymes - sources of industrial enzymes, thermophilic enzymes, amylases, glucose isomerases, cellulose degrading enzymes, lipases, proteolytic enzymes in meat and leather industry, detergents and cheese production. Immobilization of enzymes, methods and their applications. A brief account of non-protein enzymes - ribozymes and DNA enzymes.

Total : 60 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Distinguish the fundamentals of enzyme properties, nomenclatures, characteristics and mechanisms.

CO2: Apply biochemical calculation for enzyme kinetics.

CO3: Discuss the factors affecting enzymatic reactions.

CO4: Describe the concepts of co-operative behaviour, enzyme inhibition and allosteric regulation.

CO5:Compare methods for production, purification, characterization and immobilization of enzymes.

Text Books

1. David Nelson and Michael Cox, Lehninger Principles of Biochemistry, 4th edition; 2005
2. JL Jain, Sanjay Jain and Nitin Jain, Fundamentals of Biochemistry, 6th edition; 2005
3. Donald Voet and Judith Voet, Fundamentals of Biochemistry, 2nd edition; 2006
4. MJ Pelczar, ECS Chan and NR Krieg, Microbiology, Tata McGraw Hill Edition, 1998

Reference Books

1. Malcolm Dixon and Edwin Clifford Webb, Enzymes (Volume 6), 1964
2. Trevor Palmer, Understanding Enzymes, 4th edition, 1995
3. Robert K Murray , Daryl Granner and Victor W Rodwell, Harper's illustrated biochemistry, 27th edition; 2006
4. Julio Polaina and Andrew P MacCabe (Editors), Industrial Enzymes: Structure, Function and Applications (Springer), 2007

15MBC005 INTERMEDIARY METABOLISM 5 0 0 4

Course objectives

The paper intends to provide a basic understanding of the biochemical reactions of molecules, Role of enzymes as key elements that govern the biochemical transformations, break-down and synthesis of various biomolecules and the turnover of carbohydrates, proteins, lipids and nucleic acids.

Unit 1 Carbohydrate metabolism (12)

Fate of dietary carbohydrates. Glycolysis with energetic & regulation, Cori cycle, Futile cycles in carbohydrate metabolism. Metabolism of Glycogen, TCA cycle - Energetics and its regulation. Pentose phosphate pathway. Uronic acid pathway. Gluconeogenesis pathway and significance. Gloxylate cycle.

Unit 2 Lipid Metabolism (12)

Oxidation of fatty acids - Beta oxidation, alpha oxidation and omega oxidation. Metabolism of Ketone bodies - Formation, Utilization, Excretion and significance. Metabolism of Triglyceride, Phospholipids and cholesterol. Biosynthesis of saturated and unsaturated fatty acids.

Unit 3 Protein Metabolism (12)

Introduction, fate of dietary proteins, catabolism of amino acids - transamination, oxidative and non-oxidative deamination, decarboxylation- urea cycle and its regulation.

Unit 4 Nucleic acid Metabolism (12)

Introduction, fate of dietary nucleic acids, catabolism of purine and biosynthesis of purine nucleotides- denovo synthesis and salvage pathways. Regulation of purine biosynthesis. Catabolism of pyrimidines and biosynthesis of pyrimidine nucleotides. De novo synthesis and salvage pathways, regulation of pyrimidine synthesis.

Unit 5 Biological Oxidation (12)

Introduction -free energy - free energy of hydrolysis of ATP and other organophosphates. Role of High energy compounds - Electron transport chain-

Components and reactions of ETC. Role of ETC - Oxidative Phosphorylation - Chemiosmotic hypothesis. P/O ratio, uncouplers of oxidative phosphorylation.

Total : 60 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Discuss the overall concept of cellular metabolism – anabolic and catabolic pathways, energy storage and release, production of building blocks for macromolecule synthesis.

CO2: Differentiate how various organs control metabolism.

CO3: Discuss the basics of enzymes, transporters, signal transduction, and mitochondrial structure.

CO4: Explain glucose homeostasis (pathways and hormonal regulation). Discuss Krebs cycle, electron transport, and the pentose phosphate pathway.

CO5: Analyze the role of fat in energy production, membrane synthesis, and production of bioactive molecules.

Text Books

1. David Nelson and Michael Cox, Lehninger Principles of Biochemistry, 4th edition; 2005
2. JL Jain, Sanjay Jain and Nitin Jain, Fundamentals of Biochemistry, 6th edition; 2005
3. Donald Voet and Judith Voet, Fundamentals of Biochemistry, 2nd edition; 2006
4. Lubert Stryer, Jeremy M Berg and John L Tymoczko, Biochemistry 5th edition; 2005

Reference Books

1. Malcolm Dixon and Edwin Clifford Webb, Enzymes (Volume 6), 1964
2. Robert K Murray , Daryl Granner and Victor W Rodwell, Harper's illustrated biochemistry, 27th edition; 2006
3. BD Hames, NM Hooper and JD Houghton, Instant Notes in Biochemistry, 1st ed, 1997

15MBC006 PRACTICAL II BIOTECHNOLOGY LAB 0 0 5 3

Course objectives

To Understand and perform, the most recent and important methods in Molecular Biology and also understand the molecular approach used in research relevant for understanding the development and treatment of human diseases.

List of Experiments

1. Separation of proteins by SDS PAGE.
2. Determination of molecular weight of serum proteins by SDS PAGE
3. Study of enzyme activity on Native PAGE.
4. Isolation of plasmid DNA.
5. Isolation of genomic DNA from plant source.
6. Separation of DNA by Agarose gel electrophoresis.
7. Determination of size of DNA by agarose gel electrophoresis
8. RFLP.
9. Gene amplification by PCR.
10. RT-PCR (Demonstration)
11. Southern hybridization (Demonstration).
12. Western blotting (Demonstration).

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the basic principle involved in isolation of biomolecules from various biological sources

CO2: Isolate DNA from various sources – viz plant, microbes and animals

CO3: Purify DNA, RNA

CO4: Separate DNA, RNA

CO5: Separating Proteins by SDS PAGE

Text books

1. Michael R. Green, Joseph Sambrook. Molecular Cloning: A Laboratory Manual, 4th Ed.
2. S.K.Sawhney and Randhir Singh. Introductory practical biochemistry. 2nd edition.2005. .

3. Roger L. Lundblad, Fiona Macdonald**.** Handbook of Biochemistry and Molecular Biology, 4th Edition. CRC Press, 2010
4. Leland J. Cseke, Ara Kirakosyan, Peter B. Kaufman, Margaret V. Westfall. Handbook of Molecular and Cellular Methods in Biology and Medicine, 3rd Edition, CRC Press, 2011

15MBC006 PRACTICAL III MICROBIOLOGY LAB 0 0 5 3

Course objectives

To Understand and perform, the most recent and important methods in Molecular Biology and also understand the molecular approach used in research relevant for understanding the development and treatment of human diseases.

List of Experiments

1. Preparation of media
2. Sterilization techniques
3. Isolation of pure culture- serial dilution and pour plate method
4. Isolation by Spread plate method
5. Isolation by streak plate methods
6. Slab culture techniques for long term storage.
7. Simple and differential Staining techniques
8. Negative and acid fast Staining techniques
9. Spore and capsule staining
10. Fungal staining.
11. Antibiotic sensitivity disc- phenol coefficient method.
12. Estimation of growth curve of bacteria.

Course outcomes

After the completion of this course, the student will be able to

CO1: Develop skill in the preparation and sterilization of microbial medias.

CO2: Demonstrates proficiency and use of following in isolation of cultures by various methods (Serial dilution, Pour plate, Spread plate and Streak plate methods)

CO3: Perform Slab culture technique for enabling long term storage of culture medias.

CO4: Identify different types of microbes by various staining techniques (Simple and Differential, Negative and Acid fast staining techniques).

CO5: Explain and perform Spore and capsule staining techniques.

Reference Books

1. Michael R. Green, Joseph Sambrook. Molecular Cloning: A Laboratory Manual, 4th Ed.
2. S.K.Sawhney and Randhir Singh. Introductory practical biochemistry. 2nd edition.2005. .
3. Mehra, N. K. and Gupta S. K., A Handbook of Practical and Clinical Immunology, 2nd ed., 3 vols., CBS Publishers, New Delhi, (1993).
4. Leland J. Cseke, Ara Kirakosyan, Peter B. Kaufman, Margaret V. Westfall. Handbook of Molecular and Cellular Methods in Biology and Medicine, 3rd Edition, CRC Press, 2011

15MBC008 GENETICS AND MOLECULAR BIOLOGY 5 0 0 4

Course objectives

Molecular biology deals with nucleic acids and proteins and how these molecules interact within the cell to promote proper growth, division, and development. It is a large and ever-changing discipline. This course will emphasize the molecular mechanisms of DNA replication, repair, transcription, protein synthesis, and gene regulation in different organisms.

Unit 1 Genetics (12)

Gene concept and interaction of genes. Molecular structure of genes and chromosomes. Mendel's work on heredity, Mendel's mono and dihybrid experiments. Mendel's Laws, Linkage and crossing over, coupling and repulsion hypothesis, sex linked inheritance. Non-chromosomal inheritance.

Unit 2 Replication (12)

Evidences for DNA as the genetic material. Structural organization and functional elements of eukaryotic chromosomes. Prokaryotic and Eukaryotic replication, Regulation of replication, Mutation, DNA Repair, Recombination.

Unit 3 Prokaryotic Transcription (12)

Prokaryotic transcription. Inhibitiors of transcription. Post transcriptional processing of rRNA and tRNA. Regulation of transcription in prokaryotes– the lac operon, negative and positive regulation and tryptophan operon.

Unit 4 Eukaryotic Transcription (12)

Eukaryotic transcription and regulation. RNA polymerase I,II and III, promoters, transcription factors, Transcription factor motifs, Activators, repressors and enhancers, transcription complex assembly and mechanism of transcription. Post transcriptional processing of mRNA, rRNA and tRNA. Splicing, Alternative splicing, catalytic RNA (ribozymes), RNA editing, Antisense RNA.

Unit 5 Translation (12)

Genetic code and translation. The genetic code – general features, Deciphering the code, Wobble Hypothesis. Translation- activation of aminoacids, initiation,

elongation, termination in prokaryotes and eukaryotes. Regulation of gene expression in eukaryotes. DNA methylation, chromatin remodelling, DNA response elements, degradation of proteins. Protein sorting, targeting of proteins to mitochondria, chloroplast and nucleus, Receptor mediated endocytosis.

Total : 60 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the basics of heredity population genetics and master fundamental genetic calculation

CO2: Understand the synthesis of DNA and Post replication processes

CO3: Understand the synthesis of RNA and post transcriptional modifications

CO4: Understand the synthesis of protein and its post translational modifications

CO5: Describe how gene expression is regulated at different levels, how tissue-specific expression is achieved and exemplify how gene expression can be manipulated and studied experimentally

Text Books

1. De Robertis, Cell and molecular biology. Dhanpat Rai Publisher, 8th Edition, 2001.
2. Nalini Chandar, Susan Viselli, Lippincott Illustrated Reviews: Cell and Molecular Biology. LWW : North American Edition (2010).
3. Robert Franklin Weaver, Molecular Biology. Mc-Graw Hill science, 5th edition, 2011.

Reference Books

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Molecular biology of the cell. Garland Science, 6th edition (2014).
2. Benjamin Lewin, Genes IX. Jones & Bartlett Learning; 9 edition (2007).
3. Harvey Lodish, Arnold Berk & Chris A. Kaiser, Molecular Cell Biology. W. H. Freeman; 6th edition (2007).
4. James D. Watson, Tania A. Baker, Stephen P. Bell, Molecular Biology of the Gene. Benjamin Cummings, 7th Edition (2013).
5. Gerald karp, Cell and Molecular Biology: Concepts and Experiments, Wiley; 7th Edition edition (2013).

15MBC009 CLINICAL BIOCHEMISTRY 5 0 0 4

Course objective

The course aims to provide an advanced understanding of the biochemical mechanisms and pathophysiological processes responsible for common biochemical disorders. The course provides an overview of normal and abnormal metabolic functions, the impact of disorders on metabolic processes, an overall picture about the molecular basis of diseases and novel strategies to prevent the diseases.

Unit 1 Introduction and Diseases of the new-born (12)

Introduction to Basic concepts and principles of Clinical Biochemistry .Standard values for important constituents in blood and urine. Specimen collection and Processing of blood and urine. Anticoagulants. Blood groups, Blood banking and adverse reactions of blood transfusions. Hemolytic diseases of the new born. Hemoglobinopathies, Thalassemias Haemophilias. Anaemias. Amniotic fluid-origin, collection, composition and analysis. Immunological tests of pregnancy. Prenatal detection of inborn errors of metabolism in the fetus by enzyme assays in amniotic fluid.

Unit 2 Liver function tests and related disorders. (12)

Jaundice, Cirrhosis, Hepatitis, Fatty liver and gall stones. Serum enzyme activities in diseases. Renal function tests and related disorders - Acute and chronic renal failure, glomerular diseases and tubular diseases, urinary tract obstruction and analysis of urinary calculi. .

Unit 3 Other organ function tests (12)

Assessment of Gastric function Tests, Pancreatic function test and Intestinal function tests. Enzyme parameters in these pathological conditions.

Unit 4 Metabolic disorders (12)

Disorders of carbohydrate metabolism nucleic acid metabolism and lipid metabolism and their diagnosis. Aminoacidurias.

Unit 5 Cancer **(12)**

Diagnosis of Cancer – cancer cells, difference between cancer and normal cells. Diagnosis – Tumor markers, classification, functions. Medical imaging techniques – CT, MRI, PET and SPECT.

Total : 60 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the Basic concepts and principles of Clinical Biochemistry, detail on the various biological specimens including the process of collection, preservation and storage.

CO2: Gain Knowledge on the collection, and analysis of Amniotic fluid and on the Immunological tests related to diagnosis of anomalies during pregnancy.

CO3: Understand the Blood groups, Blood banking and adverse reactions of blood transfusions.

CO4: Describe of the blood clotting pathways and the blood clotting disorders.

CO5: Enumerate of the different types of anemias based on aetiology.
mellitus and various disorders of carbohydrate metabolic pathways.

Text Books

1. M.N. Chatterjee & Ranashinde, Text Book of Medical Biochemistry. Jaypee Publisher. 6th edition, 2006.
2. Nanda Maheshwari, Clinical Biochemistry**.** JPB. First edition, 2008.
3. Nessar Ahmed, Clinical Biochemistry, . Oxford University Press. 1st Edition, 2011.

Reference Books

1. Carl A. Burtis, Edward R. Ashwood and David E. Bruns (eds), Tietz Textbook of Clinical Chemistry and Molecular Diagnosis. 5th edition, 2012.
2. Thomas M. Devlin, Biochemistry with clinical correlation. John Wiley & Sons. 7th Edition, 2010.
3. Allan Gaw, Michael J. Murphy, Rajeev Srivastava, Robert A. Cowan, Denis St. J. O'Reilly, Clinical Biochemistry. 5th edition, 2013.
4. Graham Basten, Introduction to Clinical Biochemistry, Interpreting Blood Results. BookBoon. 2 nd edition, 2011.

15MBC010 PRACTICAL II CLINICAL BIOCHEMISTRY LAB 0 0 8 3

Course objectives

Clinical biochemistry is a scientific discipline within medicine. It includes the analysis of body fluids, cells and tissues and interpretation of the results in relation to health and disease. The discipline encompasses fundamental and applied research into the biochemical and physiological processes of human and animal life, and application of the resulting knowledge and understanding to the diagnosis, treatment and prevention of disease.

List of Experiments

Analysis of Biological Samples

1. Hematological analysis-RBC, WBC-TC/DC, Hemoglobin content and ESR
2. Analysis of normal and abnormal urine constituents
3. Estimation of Calcium

Enzyme assays

4. Assay of Enzymic antioxidants-SOD, Catalase and GPx
5. Assay of Creatine kinase, LDH and Na^+ K^+ ATPase
6. Assay of SGOT/ SGPT

Biochemical Studies

7. Estimation of renal indices-Urea, Uric acid and Creatinine.
8. Estimation of Blood Glucose
9. Estimation of Serum Bilirubin
10. Estimation of A:G ratio in serum
11. Estimation of serum Cholesterol.
12. Estimation of Vitamins-A & E

Course outcomes

After the completion of this course, the student will be able to

CO1: Gain knowledge of biological samples and their collection procedures

CO2: Perform biochemical laboratory analysis in blood and urine samples and interpret the generated results after analysis in order to determine the likely diagnosis

CO3: Distinguish serum, plasma and whole blood emphasizing the role of

anticoagulants

CO4: Assess presence and absence of normal and abnormal constituents in urine by performing qualitative urine analysis

CO5: Analyze blood for RBC, WBC, TC/DC, ESR and hemoglobin by performing hematological assays

Text Books

1 J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers. 2011 (Paperback).

2 S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009

3 S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd. 2 edition, 2005.

Reference Books

1 Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.

2 Hans Bisswanger, Practical Enzymology. Wiley VCH. 2nd Edition, 2011.

3 Robert Eisenthal, Enzyme Assays: A Practical Approach (Practical Approach Series). Oxford University Press, U.S.A. 2 edition, 2002.

15MBC011 TOXICOLOGY AND FORENSIC BIOCHEMISTRY 5 0 0 4

Course objectives

This paper provides a complete understanding of the responses of the human body to toxic agents and the therapeutic approaches to toxicity. The paper also deals with the forensic aspects like legal procedures and types of trauma.

Unit 1 Introduction to toxicology (12)

Fundamentals of Toxicology and dose-Response Relationships. Factors Affecting Toxic Responses: Disposition : Absorption ,Sites of absorption, distribution, Excretion; Metabolism: types of Metabolic change phase I reactions; Phase 2 reactions; control of Metabolism, Toxication vs. Detoxication. Biochemical basis of toxicity: Mechanism of toxicity: Disturbance of excitable membrane function, Altered Calcium homeostasis, Covalent binding to cellular macromolecules & genotoxicity, Tissue specific toxicity

Unit 2 Clinical toxicology (12)

Types of poison, Clinical signs and Symptoms, diagnosis, management and medicolegal aspects of corrosive poisons; irritant poisons; neural poisons; somniferous; inebrient; delirient; spinal; peripheral; cardiac poisons; asphyxiants; drug abuse.

Unit 3 Introduction to forensics (12)

Legal procedures in India; medical and medico Legal documents; evidences, witnesses; laws related to medical profession. Medical Council of India, State Medical Council: structure, functions, powers; duties of medical practitioners towards patients and relatives, medical negligence: civil, criminal; Consumer Protection Act: rights and liabilities of doctors, medical indemnity insurance; human rights and violation; duties of medical practitioners to victims of torture; Human organ transplantation Act.

Unit 4 Identification procedures (12)

Identification of the living and the dead. Forensic thanatology; death; causes of death; mechanism and manner of death; changes after death; artifacts; medico-legal

death investigation; exhumation. Forensic science; Locard's exchange principle; lie detector; superimposition; DNA finger printing, HLA typing.

Unit 5 Pathology (12)

Injuries - mechanical injuries; injuries; injuries; injuries due to electricity, lightning and radiation; train and road traffic accidents; firearm and explosion injuries; medico legal aspects of wounds. General aspects; patho-physiology and classification ;mechanical asphyxia; hanging; strangulation; drowning; smothering, choking, garroting, burking, yoking.

Total : 60 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the basic concepts of toxins and the biochemical basis of their toxicity

CO2: Know the different types of poisons and their effects

CO3: Know the poison associated effects under Forensic Science

CO4: Have the knowledge about legal procedures in India and the proceedings involved in criminal cases

CO5: Have basic understanding of identification procedures employed under Forensic toxicology

Text Books

1. Narayanareddy K. S., The Essentials of Forensic Medicine & Toxicology, 2007Published by K. Sugana Devi, 26th Edition, Hyderabad.
2. Basu, R. Fundamentals of forensic medicine and toxicology. 2009. 2nd Edition. Books and Allied(P) Ltd. Kolkata.

Reference Books

1. Parikh C.K. Parikh 's Textbook of Medical Jurisprudence and Toxicology, Publishers Bangalore . 6th Edition 1999, Reprint 2007
2. Franklin, C.A Modi's medical Jurisprudence and Toxicology, published by M. Tripathi Private Limited,.21st Edition. Bombay.
3. Keith Simpson, Bernard Knight, 1988, Forensic Medicine, ELBS. 9th Edition
4. Pillay V.V., Text book of Forensic Medicine,2009, Paras Publication. Hyderabad

5. JB Mukherjee's Forensic Medicine and Toxicology – Volume I and II (combined)- edited by Karmakar ,III Edition 2007.

DISCIPLINE SPECIFIC ELECTIVES

15MBC101 HUMAN PHYSIOLOGY AND BASICS OF ANATOMY 4 0 0 4

Course objectives

The objective is to impart knowledge and understanding of the human body. To understand the inter relationships within and between anatomical and physiological systems of the human body.

Unit 1 Basics of Human anatomy (09)

Definition and scope of anatomy, physiology and related sciences. Anatomical terms in relation to parts of the body, system and organs. Cell- Structures and their functions. Tissues of the Body- Types of tissues and their functions.Muscles – structure, types and functions.

Unit 2 Digestive system (09)

Structure and functions of alimentary canal - mouth, oesophagus, stomach, small intestine, large intestine. Digestive enzymes, zymogens – salivary gland, gastric gland, liver, pancreas and intestinal glands. Digestion and absorption of carbohydrates, fats and proteins. Defaecation.

Unit 3 Blood and Respiratory system (10)

Composition of blood. Structure, of RBC, WBC and platelets. Blood clotting – blood clotting factors and mechanism of blood clotting. Haemostasis. Blood groups- ABO system and Rhesus system. Structure of Respiratory system. Functions of pharynx, larynx, trachea, bronchi and bronchioles and lungs. Physiological and biochemical events of respiration – Breathing, exchange of gases and regulation of respiration- Bohr effect and role of 2,4 DPG.

Unit 4 Nervous system (10)

Nervous System - General physiology of neurons, synapses, neurohumoral transmission. Central nervous system, its various parts and their functions.Structure and functions of the urinary system - kidneys, ureter, urinary bladder and urethra. Micturition. Mechanism of urine formation –GFR, tubular reabsorption and tubular secretion. Role of ADH.

Unit 5 Reproductive system (10)

Structure and functions of male reproductive system`. Structure and functions of female reproductive system – Ovulation, menstrual cycle. Spermatogenesis and factors influencing sperm count and viability. Biochemistry of fertilization.Physiological changes during pregnancy, parturition and lactation.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the inter relationships within and between anatomical and physiological systems of the human body

CO2: Describe the structure of major human organs and explain their role in the maintenance of healthy individuals.

CO3: Understand the role of Membranes and its transport mechanism.

CO4: Know in detail about the 4 levels of biological tissues.

CO5: Describe the general function of each organ system.

Text books

1. Guyton AC. Text book of Medical Physiology, 8th Edition. Prism books (pvt), Bangalore, India. ... TATA McGraw-hill publishing Company,1991.
2. C.C. Chatterjee, “Human Physiology”(Vol. I & Vol. II), Medical Allied Agency, Calcutta, 11th edition, 1985.

Reference books

1. Ganong (Williams) Review of medical physiology 25th edition. 2015.McGraw-Hill/Appleton & Lange.
2. Ross and Wilson. Anatomy and physiology. In health and illness. 12th edition, 2014. Churchill livingstone Elsevier.

15MBC102 **CELL BIOLOGY** **4 0 0 4**

Course objectives

Cell biology is increasingly important in all life sciences. Many of the advancements in modern science are the result of a better understanding of cellular components and their functions. An understanding of cell biology is an asset in modern science, it provides knowledge about the composition, structure and function of organelles and other cellular components and their biological activities.

Unit 1 Introduction to cell and cell membrane (10)

Cell as a basic unit of living system. Biochemical composition of cell: protein, lipid, carbohydrate, nucleic acid. The cell theory. Ultrastructure of cell. Membrane composition, lipid bilayer/membrane. Membrane functions – simple diffusion, Facilitated transports. Active transport, Endocytosis, Pinocytosis, Phagocytosis, Exocytosis.

Unit 2 Organelles (10)

Structure and Function of the Endoplasmic reticulum, Golgi complex, Lysosome, Ribosome, Mitochondria and Chloroplast.

Unit 3 Nucleus (09)

Structure and Function of Nucleus, Nuclear envelope, Structure of Chromatin, Organization of chromatin. Structure and functions of nucleolus.

Unit 4 Dynamics of the cell (09)

Cell cycle, Cell- cell interaction, recognition and adhesion, Cell locomotion (amoeboid, flagellar and ciliar). Cell senescence and death. Cell differentiation.

Unit 5 Cytotechniques (10)

Methods of Cell Study: Simple and compound microscope, Phase contrast, dark field and polarization microscopy, Electron microscopy, SEM, TEM; freeze fracture. Fluorescence and Confocal microscopy; imaging live cells. FRET and FRAP. Atomic force microscopy. Flow -Cytometry and cell sorting (FACS).Plant tissue culture.

Animal and insect tissue culture. Methods of cell disruption and fractionation, isolation of organelles.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Describe the origin of life, from the abiotic world to multicellular organisms, including an account of endosymbiosis

CO2: Explain the structural characteristics of prokaryotic and eukaryotic cells

CO3: Explain the structure, properties and functions of various classes of macromolecules in cells

CO4: Describe the intricate relationship between various cellular organelles and their corresponding functions

CO5: Explain organization of DNA and its involvement in the process of inheritance

Text Books

1. Devasena.T, Cell Biology. Oxford University Press India; First edition (2012).
2. Rastogi . S.C, Cell Biology. newagepublishers (2008).

Reference Books

1. David L Nelson & Michael M Cox, Lehninger -Principles of biochemistry.W.H. Freeman company New York 4th edition 2007.
2. Garrett Grisham, Biochemistry. International student's edition. 3'rd edition
3. Karp G, Cell and Molecular Biology: Concepts and Experiments. John Wiley & Sons. Inc. 6th Edition.2010
4. De Robertis E.D.P & De Robertis E.M.F. Cell and Molecular Biology.2006.
5. Cooper, G.M. and Hausman, R.E. The Cell: A Molecular Approach. Sinauer Associates, Inc.; 6 edition,2013.

15MBC103 FUNDAMENTALS OF COMPUTERS, BIOSTATISTICS AND RESEARCH METHODOLOGY 4 0 0 4

Course objectives

The course was designed in such a way to get hands on training in the Biochemical methods in the aspect of doing research and to impart the knowledge of Statistics and Design of Experiments to the students. This will help the students to have focused idea about the research methodologies and how to write research findings with the help of biostatistics and computer.

Unit 1 Fundamentals of Computers (10)

Computer in Biological Research - Components of Computer - storage device, computer peripherals, Computer virus Protection. Word Basics- Creating and working with documents, working with text Tables, Using EXCEL-working with work sheet, Creating chart- working with formula and functions, Using power point-working with power point user interface, Using templates and wizard for Slide Presentation, Creating charts and tables, Internet and WWW, Electronic mail- internet browsing.

Unit 2 Biostatistics and Research - I (10)

Steps in Scientific research, Sample - Variables, Graphic Representation, Frequency Distribution- Types, Mean, Mode and Median and measures of central tendencies, Standard Deviation and Related measures

Unit 3 Biostatistics and Research - II (10)

Biostatistics and Research- Probability- Hypothesis testing for Significance. Chi Square and Students Test, Regression and correlation- ANOVA, TUKEY's TEST and DUNCUN's TEST. Introduction to statistical softwares.

Unit 4 Molecular Techniques (09)

PCR, RAPD, RFLP, BLOTTING Techniques, Immunological techniques - ELISA, RIA. Basic concepts of cryopreservation,.

Unit 5 Thesis Preparation and Writing (09)

Basics Steps in research –Problem Selection- Experimental design- Review of Literature- Types of Literature- Reprint requisition, Preparation of Research Report/ Dissertation/Review- Abstract, Short notes, Contents of Dissertation (Introduction, Methodology, Results, Discussion, Summary, References/ Bibliography), Citation of Reference- Presenting Tables, Figures, Plates, Annexure, Acknowledgement, Formatting and Typing- Proof Reading.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Explore the basic components of computer and methods of protecting system from virus.

CO2: Learn the applications of packages like WORD, EXCEL, Power Point in entering data, preparing tables, graphs, charts etc.,

CO3: Study applications of statistical tools like Mean, Median, Mode, Standard deviation, Standard error,'t' test and ANOVA in biological research.

CO4: Learn usage of statistical software like SPSS, Graph pad

CO5: Understand the general principle, Instrumentation and applications of PCR RAPD, RFLP, blotting in molecular biology research.

TextBooks

1. Levin and Rubin, Statistics for Management, 1998, 7th Edition, Prentice hall of India.
2. N. Gurumani, Research Methodology for Biological Science,2006, MJP Publisher

Reference Books

1. Anderson.j.et al, Thesis and assignment writing, 1970, Wiley eastern Pvt. Ltd. Delhi
2. Alexis Lcon and Mathew's icon, Fundamentals of Information Technology, 1999, Wikas Publisher.

3. C. R. Kothari, Research Methodology: Methods and Techniques, 2005. 2nd Edition, New Age international(P) Limited, India,

15MBC104 PHYTOCHEMISTRY, PHARMACOGNOSY & QUALITY CONTROL 4 0 0 4

Course objectives

This paper deals with the study of the physical, chemical, biochemical and biological properties of drugs, drug substances or potential drugs of natural origin as well as the search for new drugs from natural sources. It enables the students to study procedures undertaken to ensure the identity and purity of a particular pharmaceutical compounds.

Unit 1 Phytoconstituents of medicinal importance I (10)

Glycosides, Anthraquinones. Flavonoids (definition, natural sources, classification, biogenesis, extraction, isolation, identification and therapeutic applications). Anthocyanins Coumarins, Terpenes, Volatile Oils (definition, classifications, natural sources, medicinal and non medicinal uses, pharmacological and toxicological effects).

Unit 2 Phytoconstituents of medicinal importance (10)

Saponins and Alkaloids (definition, natural sources, classification, physical and biological properties, localization,nomenclature, physico-chemical properties, extraction, detection, isolation, purification, biosynthetic origin and pharmacological activities.

Unit 3 Pharmacognosy (10)

Historical development, modern concept and scope of Pharmacognosy. Significance of Pharmacognosy in various systems of medicine *viz*; Ayurveda, Unani, Homeopathic, Siddha and Allopathic systems practiced in India. Common drugs of plant origin. Quantitative microscopy-an overview. Importance of authentication of plants. Preparation of herbal extracts. Natural pesticides and Insecticides-Tobacco, Pyrethrum, Neem. Introduction to herbicides and fungicides. Study of Indian toxic plants.

Unit 4 Pharmaceutical regulations (09)

Harmonization of regulatory requirements including ICH activity. Regulatory requirements of different regions applicable to pharmaceutical developments, manufacturing, quality control on finished products, extended release products, biopharmaceutical and bioequivalence assessment and good clinical practices and comparison with regulation in India. Filing of INDA, NDA and ANDA for approval and registration.

Unit 5 Stability testing (09)

Role of stability testing, stability test guidelines. Protocol of stability testing including testing under different climatic zones and conditions. Conduct of stability testing, presentation and recording of stability data, determination of shelf life. Stability test equipment and recent developments in this area. Documentation: Importance of documentation, statuatory requirements and procedure for documentation, critical examination of documents.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the basic terminologies: pharmacognosy, medicinal plant, crude drug, folk medicine and flora.

CO2: Classify herbal drugs according to botanical origin, chemical constituents, and medicinal activity.

CO3: Explain different methods of cultivation, collection, curing, drying, adulteration and storage of medicinal plants.

CO4: Discuss different types of plant cells, secretory structures, different classes of secondary metabolites and their chemical identification.

CO5: Describe methods for detection and identification of natural drugs, especially leaves, fruits, seeds, herbs, barks and wood macro- and micro-morphologically and chemically

Text Books

1. C.K. Kokate, A.P. Purohit and S.B. Gokhle, Pharmacognosy, Nirali prakasham, 42nd edition: sep 2008.

2. Gupta, Vijay Kumar and Singh, Medicinal plants: Phytochemistry , Pharmacology and Therapeutics –Vol 3, Daya publishing house, 1st edition, 2014.

Reference Books

1. Herbal Medicines, A Guide for Health Care Professionals- By Carol A. Newal, Linda A. Anderson and J. David Phillipson. (1997).
2. Biren Shah, Avinash seth, Text books of Pharmacognosy and Phytochemistry; Elsevier india publishers, 1st edition,2012.
3. Ashutosh Kar, Pharmacognosy and Pharmacobiotechnology; New age india (P) ltd publisher; 2nd edition, 2007.

15MBC105 MICROBIOLOGY AND IMMUNOLOGY 4 0 0 4

Course objectives

This paper assures that Biochemists should have strong ideas about Microbes and their applications, immunity, antigens, antibodies against them, mechanism of action of immune system.

Unit 1 Basics of Microbiology (09)

History and scope of Microbiology. Classification of microbes. Ultra structure of Bacteria , Fungi , virus , Algae. Food and dairy Microbiology: Role of Microorganism in food production – Dairy and non dairy products, fermented and alcoholic beverages. Antimicrobial agents – physical and chemical agents. Antiseptics and sterilants. Pharmaceutical Microbiology: Production of antibodies, Vaccines, antisera.

Unit 2 Industrial Microbiology (10)

Products of Industrial Microbiology- Penicillin, ethanol, Vitamin-B12, Citric acid, Amylase, Protease. Soil & Environmental Microbiology: Nitrogen fixation – symbiotic, asymbiotic. Pollution of water by microbes – sewage treatment, Bioremediation. Clinical Microbiology: Infection – types of infection, method of infection, factors influencing infection. Normal microbial flora and pathogenic microbes. Bacterial diseases - typhoid, cholera. Viral diseases - Hepatitis, HIV.

Unit 3 Immunity (10)

Immunity and its types- innate immunity, acquired immunity, active and passive immunity, Humoral and cellular immunity. Cells of the immune system. Complement pathway. Immunoglobulins- structure, function and types. Antigens- nature, immunogenicity, haptens. Molecular mechanism of generation of antibody diversity. Monoclonal antibody – preparation and application in clinical research. Antigen-antibody reactions: precipitation, agglutination, Complement fixation test, tissue typing, ELISA, RIA, immunoflourescense, Immunodiffusion; Immunoblot.

Unit 4 Hypersensitivity (10)

Hypersensitivity reactions- type I, II, III, IV. Immunological tolerance & autoimmunity. Vaccines- active and passive immunization, commonly used toxoid vaccines, killed vaccines, live attenuated vaccines and bacterial polysaccharide vaccines.

Unit 5 Transplantation and cancer immunology (09)

Transplantation immunology- clinical manifestation, therapy, bone marrow and organ transplants. Cancer immunology- tumor antigens, immune response to tumors, immunotherapy. Structure and functions of MHC, association of MHC with disease susceptibility. Immunodeficiency disorders.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Demonstrate various classes and structure of microbes. Applications of microbes in food industry and pharma industry.

CO2: Discuss preparation and applications of products from industries. Role of microbes in nitrogen fixation, purification of water,

CO3: Discuss the classification of immunity, cell mediated immune response, humoral immune response.

CO4: Explain the structure, types of antigens and antibodies.

CO5: Explain active and passive immunity

Textbooks

1. Microbiology- Prescott 2003 , 3rd edition, Magraw hill , Boston.
2. Roitt, Brostoff, Mal, Immunology, 6th edition, 2001

Reference Books

1. Panicker , Microbiology, orient Longman , Hyderabad, 6th edition, 2005.
2. M.J.Pelzar, Microbiology, Tata mac hran, Hill New Delhi, 5th edition, 2005.
3. Donald.M.Weir, Immunology, John Stewart, 7th edition, 1993
4. P.M.Lydyard, A.Whelan, M.W. Fanger, Immunology, 2003

15MBC106 BIOTECHNOLOGY AND IPR 4 0 0 4

Course objectives

The content of the syllabus consist of basic biotechnology and its application such as new tools , products developed by biotechnologists such as cell culture, transgenic animals, Genetic engineering are useful in research, agriculture, industry and the clinic. It also helps to understand the Basic principles involved in Intellectual properties rights , scope and importance of marketing and its systems.

Unit 1 Vectors (10)

Restriction enzymes and joining DNA molecules by DNA ligase, double linkers, adaptors, homopolymer tailing. Plasmids vectors (pBR322, pUC 18), phage vectors (M13), cosmids, expression vectors, yeast vectors –YAC. Selection and screening of recombinants by genetic methods, immunochemical methods, nucleic acid hybridization methods. Synthesis of probes by radioactive and non–radioactive labeling. Analyzing DNA sequences by Maxam and Gilbert method and Sanger's methods.

Unit 2 Gene transfer methods (09)

Introduction of Foreign Genes into Cells using direct gene transfer methods - electroporation, biolistic transfer, transfection, microinjection, lipofection and ultrasonication. Genomic DNA libraries, chromosome walking, cDNA cloning, PCR, RAPD and RFLP.

Unit 3 Cell culture (10)

Cell and organ culture, primary cell culture, serum and serum free media, transfer of genes into animal cells in culture. Viral vectors: SV40, retrovirus and adenovirus. In vitro fertilization and embryo transfer. Selectable markers and reporter transgenes. Gene therapy and Antisense therapy.

Unit 4 Transgenic animals (10)

Production of medically important biomolecules - insulin, growth hormone, interferons, blood proteins, vaccines, lyphokines and monoclonal antibodies. Production of transgenic animals – transgenics and knock-outs. Production of

transgenic sheep, cattle, pigs, fish etc. Development and applications of transgenic animals.

Unit 5 IPR (09)

Intellectual Property Rights (IPR) and Protection, Intellectual Property rights for Plant Breeding, Biosafety in biotechnology and Bioethics. Biotechnology Entrepreneurship.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Explain the general principles of generating transgenic plants, animals and microbes.

CO2: Identify and debate the ethical, legal, professional, and social issues in the field of biotechnology and design and deliver useful modern biotechnology products to the Society**.**

CO3: Understand the role of vectors, plasmids in gene technology

CO4: Understand the gene transfer methods

CO5: Understand the DNA sequencing methods

Text Books

1. Sathyanarayana, Biotechnology, Books and allied Publishers, 3rd edition, 2006
2. RC Dubey, Text book of Biotechnology , S. Chand & Co, 2009

Reference Books

1. Brown TA “Gene cloning: An introduction” Nelson Thornes, 3rd edition, 1995
2. SS Purohit. Biotechnology Fundamentals and applications. Agrobios Publication. 4th edition. 2007
3. SB Primrose & R Twyman. Principles of gene manipulation and genomics. Blackwell publishing. 7th edition. 2006.
4. PK Gupta, Biotechnology and genomics. Rastogi Publication.2nd reprint. 2006.

15MBC107 MODERN LIFESTYLE ASSOCIATED DISEASES 4 0 0 4

Course objectives:

The objective is to make a connection between knowledge of anatomy and physiology and real-world situations, including healthy lifestyle decisions and homeostatic imbalances.

Unit 1 Modern lifestyles and habits (09)

Modern lifestyles - Sedentary habits, Junk food, Polluted environment, Sleeping habits, Smoking, Alcoholism, Drugs, Stress.

Unit 2 Food (09)

Elementary knowledge of balanced food. Obesity, Acidity, Dieting, Anorexia, Food poisoning. Deficiency of nutrients- Vitamins, Minerals, Beverages- hot and cold.

Unit 3 Cardiovascular complications (10)

Elementary knowledge of cardiovascular system: Atherosclerosis, Ischemia, Myocardial infarction (Heart attack), Hypertension.

Unit 4 Diseases of the Digestive system (10)

Elementary knowledge of digestive system and liver- Hepatitis, Fatty liver, Cirrhosis, Gallstones. Stomach- Gastritis, Acidity, Ulcer, Amoebiasis, Constipation, Piles.

Unit 5 Diseases of the Digestive system (10)

Elementary knowledge of Respiratory system- Common cold, Asthma, Wheezing, Allergic sinusitis. Elementary knowledge of Excretory system, Hypertension, Uncontrolled Diabetes, Kidey Stones.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Gain knowledge about the human anatomy and physiology

CO2: Gain insights about the current lifestyle as a consequence of industrialization

CO3: Understand global scenario on sedentary lifestyle nutrition

CO4: Understand Basics of nutrition, RDA, balanced diet and BMR

CO5: Gain knowledge about cardiovascular system and associated disorders

Text Books

1. Carl A. Burtis and Edward R. Ashwood . Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, 5edition, 2012. Saunders Publication.
2. M N Chatterjee and Rana shinde. Textbook of Medical Biochemistry-,8th edition, 2011. Jaypee Publishers.

Reference Books

1. Thomas M. Devlin. Biochemistry with Clinical Correlation, 7th edition, John Wiley & Sons. 2004.
2. Harold Varley, Practical Clinical Biochemistry, fourth edition, 2005. CBS Publisher
3. Dennis L. Kasper, Anthony S. Fauci, Stephen L. Hauser, Dan L. Longo. Harrison Principles of Internal Medicine- 19th edition, 2015

15MBC108 NEUROBIOLOGY 4 0 0 4

Course objectives

This paper provides a basic understanding of the nervous system, Structure and function relationship and integration of the nervous tissue networking and insights in to neurotransmission

Unit 1 Neuron (10)

Neuron- Neurocellular anatomy, neural membrane, classification of neuron, nerve fibers, axonal transport, neural growth, neuroglia , nervous system, blood brain barrier, cerebrospinal fluid.

Unit 2 Nerve potential (09)

Neuronal signaling -Membrane potentials, ion channels, recording neuronal signals, ionic basis of resting potential and action potential, propagation of action potential.

Unit 3 Synapse (09)

Synaptic transmission- Synapse, Electrical synapse transmission, chemical synaptic transmission, Synaptic transmitter release, synaptic potentials, synaptic delay, synaptic plasticity, molecular mechanism of synaptic transmission, myoneural junction.

Unit 4 Neurotransmitters (10)

Neurotransmitters- Chemistry, synthesis, storage, release, receptors and function-acetyl choline, catecholamines, serotonin, histamine, glutamate, asparatate, GABA, glycine, neuropeptides, nitric oxide.

Unit 5 Neuro disorders (10)

Neural processing and neurodegenerative disorders-Learning and memory, neurochemical basis of drug abuse, neurodegenerative disorders, Parkinson's disorder, Alzheimer's disorder, Amyotrophic Lateral Sclerosis, Senile Dementia.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the physiology of human nervous system

CO2: Understand the anatomy of the central nervous system and its integration with the peripheral nervous system

CO3: Explain the anatomy and physiology of neurons

CO4: Gain knowledge on the structure and function of different types of cells of the nervous system

CO5: Understand neuronal signaling and synaptic transmission importance

Text Books

1. Arthur C. Guyton and John E Hall, Text book of medical physiology 11th Edition; 2006
2. David Nelson and Michael Cox, Lehninger Principles of Biochemistry, 4th edition; 2005

Reference Books

1. Bruce Alberts, Alexander Johnson, Juliana Lewis, Martin Raff, Keith Roberts and Peter Walter, Molecular biology of the cell, 4th Edition; 2004
2. Gordon Shepherd, Neurobiology, 3rd Edition; 1994
3. Mark F Bear, Barry W Connors and Michael A Paradiso, Neuroscience: Exploring the brain, 4th Edition; 201

15MBC109 ENDOCRINOLOGY 4 0 0 4

Course objectives

This paper ascertains that the biochemists get an accurate information about various hormones, functions, mechanism of action, and related disorders.

Unit 1 Pituitary Hormones (10)

Hormones – Classification, biosynthesis, transport, modification and degradation. Structure of receptors, Feedback regulation. Mechanism of hormone action. Hypothalamic and pituitary hormones. Hypothalamic releasing factors. Hypothalamic hypophysealportal system. Anterior pituitary hormones- GH, TSH, ACTH, LH, FSH and PRLbiological role, feedback regulation and related disordersof hypo and hyper secretion.. Posterior pituitary hormones-oxytocin and vassopressin – biological actions, regulation and related disorders.

Unit 2 Thyroid hormones (09)

Thyroid hormones – synthesis, secretion, regulation, transport, metabolic fate and biological actions. Antithyroid agents. Hyper and hypothyroidism. Hormonal regulation of calcium and phosphate metabolism. Parathyroid hormones- Parathormone and Calcitonin -biological actions, and related disorders-. Hypercalcemia and hypocalcemia, Rickets and osteomalacia.

Unit 3 Adrenal Hormones (10)

Hormones of Adrenal cortx- Synthesis, action, biological role, regulation, transport and metabolism. Adrenal function tests. Disoders of adrenal cortex-Cushing's syndrome, aldosteronism, Congenital adrenal hyperplasia, Adrenal cortical insufficiency. Hormones of Adrenal medulla synthesis, biological role, metabolism, regulation and related disorder- Phaeochromocytoma.

Unit 4 Pancreatic hormones (10)

Pancreatic hormones – synthesis, regulation, biological effects and mechanism of action of glucagon, somatostatin and insulin. Insulin receptors. Related Disorders – Diabetes mellitus. Brief account of gastrointestinal Hormones.

Unit 5 Gonadal hormones (09)

Gonadal hormones - Biosynthesis, biological actions, transport, regulation and metabolism of androgens, oestrogen and progesterone., The menstrual cycle. Pregnancy –Biochemical changes and diagnostic tests. Gonadal Disorders.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the basic terminologies of hormones, classification of hormones based on its chemistry.

CO2: Deduce the structure of amino acid derived, protein and steroid hormones.

CO3: Understand the synthesis of various hormones by respective gland.

CO4: Understand the regulation of hormones action by feedback mechanism.

CO5: Understand the mechanism of action of steroid hormones,

Text Books

1. Prakash.S.Lohar, Endocrinology, MJP Publishers, 2005
2. R.Radheshyam, Textbook of Endocrinology, Neha Publishers, 2012.

Reference Books

1. Hadley ME, The vertebrate endocrine system, in. Endocrinology, 4th Edition (Prentice Hall, NJ) 1996.
2. C. Guyton, MD and John E. Hall, Textbook of Medical Physiology, 11th Edition, 2006
3. Larsen: Williams Textbook of Endocrinology, 10^{th} ed. , 2003 Elsevier
4. R.Radheshyam, Behavior endocrinology, Neha Publishers, 2013

15MBC110 PLANT BIOCHEMISTRY 4 0 0 4

Course objectives

This paper provides insights into the primary metabolic pathways occurring in plants, the types of plant metabolites and the industrial potential of those metabolites and the role of hormones in plant growth.

Unit 1 Photosynthesis (10)

Ultra Structure and organization of chloroplast membranes, lipid composition of chloroplast membranes, electron transport chain. Thylakoid membrane protein complexes. Calvin cycle: Biochemistry of RuBp Carboxylase or oxygenase, Hatch and slack pathway, CAM plants; productivity of C_4 plants.

Unit 2 Nitrogen Metabolism (09)

Nitrogen fixation, nitrogenase complex, electron transport chain and mechanism of action of nitrogenase. Structure of 'NIF'genes and its regulation, Hydrogen uptake and bacterial hydrogenases, Nitrate Metabolism: Enzymes of nitrate metabolism, Ammonium assimilation enzymes: glutamine synthetase, glutamate synthase and GDH.

Unit 3 Plant Hormones (09)

Plant growth regulators: Auxins; gibberellins, cytokines, abscicic acid and ethylene - biosynthesis and their metabolic functions, synthetic growth hormones, inhibitors. Stress response in Plants.

Unit 4 Secondary metabolites I (10)

Major chemical classes of secondary metabolites: A brief account of the following classes: Alkaloids, terpenoids, flavonoids, Phenolics and phenolic acids,steroids, coumarins, quinines, acetylenes, cyanogenic glycosides, amines and nonprotein amino acids,gums, mucilages, resins etc. (Structures not necessary. Give examples of the compounds and the plants in which present and their importance).

Unit 5 Secondary metabolites I (10)

Importance of secondary metabolites: Uses of secondary metabolites to man: as

drugs, precursors of drugs in pharmaceutical industry, as natural pesticides/insecticides; other uses of secondary metabolites.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Develop a basic understanding of biochemical events associated with structural arrangement of plant cell and organization.

CO 2: Explain and understand the biochemistry of photosynthetic process and its relation to man and its environment.

CO3: Understand the mechanism of Nitrogen fixation and its importance in agricultural production and economics.

CO4: Know the significance of plant growth regulators in the development of plants.

CO5: Acquire knowledge about the importance of secondary metabolites and its industrial applications. Growth regulators and secondary metabolites and its potential in crop development.

Text Books

1. H.D Kumar and H.N Singh. Plant Metabolism Publisher. Macmillan, ISBN-10: 0333256387: ISBN-13:978-0333256381.1st Ed, 1980.
2. K.G Ramawat, Biotechnology: Secondary Metabolites Publisher: Science Publishers, U.S. ISBN-10: 1578080576 ISBN-13: 978-1578080571, 1st Ed., 2000.

Reference Books

1. P.M Dey and J.B. Harborne (Editors) Plant Biochemistry, Publisher: Academic Press ISBN-13:978-0122146749, 1st Ed, 1997.
2. Prof David T. Dennis, Prof David H. Turpin, Dr Daniel D. Lefebvre and Dr David B. Layzell(Ed) Plant Metabolism, publisher: Longman; ISBN-13:978-582259065, 1st Ed, 1997.
3. Hans-Walter Heldt Professor Em, Plant Biochemistry, publisher: AcademicISBN-10: 0120883910 ISBN- 13: 978-0120883912, 3rd Ed, 2004.

15MBC111 BIOCHEMICAL TOXICOLOGY 4 0 0 4

Course objectives

This paper provides a complete understanding of the responses of the human body to toxic agents and the therapeutic approaches to toxicity. The paper also deals with the forensic aspects like legal procedures and types of trauma.

Unit 1 Fundamentals of toxicology (10)

Fundamentals of Toxicology and dose-Response Relationships: Introduction Biomarkers Criteria of Toxicity New Technologies Evaluation of Toxicity Interactions; Dose Response; Measurement of Dose-Response; Relationships Linear Dose Response Hormesis; Hazard and Risk Assessment Duration and Frequency of Exposure and Effect

Unit 2 Toxic responses (09)

Factors Affecting Toxic Responses: Disposition : Absorption ,Sites of absorption, distribution, Excretion; Metabolism: types of Metabolic change phase I reactions; Phase 2 reactions; control of Metabolism, Toxication vs. Detoxication

Unit 3 Toxicity testing (09)

Test protocol, Genetic toxicity testing & Mutagenesis assay: *In vitro* test systems: bacterial mutation tests-Reversion test,Ames test, Fluctuation test, and Eukaryotic mutation test. *In vivo* test system Mammalian mutation test-Host mediated assay and Dominant Lethal test. Biochemical basis of toxicity: Mechanism of toxicity: Disturbance of excitable membrane function, Altered Calcium homeostasis, Covalent binding to cellular macromolecules & genotoxicity, Tissue specific toxicity

Unit 4 Xenobiotics (10)

Toxic Responses to Foreign Compounds: Direct Toxic Action: Tissue Lesions; Mechanism and response in cellular toxicity, pharmacological, physiological and Biochemical effects; Developmental Toxicology-Teratogenesis; Immunotoxicity Genetic Toxicity; Chemical Carcinogenesis

Unit 5 Mechanisms of toxicity (10)

Biochemical Mechanisms of Toxicity:Tissue Lesions: Liver Necrosis; kidney Damage; Lung Damage, Liver damage, Cardiac damage; Neurotoxicity; Exaggerated and Unwanted pharmacological effects; Physiological effects; Biochemical Effects: Lethal Synthesis and Incorporation, Interaction with specific Protein Receptors; Teratogenesis; Immunotoxicity; multi-Organ Toxicity:

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the basic principles of and have current, cutting-edge knowledge in human health toxicology

CO2: Describe toxicological mode of actions for most important groups of chemical substances to humans and environmental species.

CO3: Define the most vulnerable target organ(s) or organism(s) for most important group of xenobiotics.

CO4: Demonstrate knowledge on safety toxicology, and extrapolation from animal to human.

CO5: Understand the use of physico-chemical parameters of compounds to predict toxicity, bioaccumulation and biomagnification

Text Books

1. Narayanareddy K. S., The Essentials of Forensic Medicine & Toxicology, 2007. Published by K. Sugana Devi, 26th Edition, Hyderabad.
2. Basu, R. Fundamentals of forensic medicine and toxicology. 2009. 2nd Edition. Books and Allied(P) Ltd. Kolkata.
3. Apurba Nandy, Principles of Forensic Medicine,2005, Published by New Central Book Agency.
4. Guharaj P. V., Forensic Medicine, 2003, Orient Longman Limited, Hyderabad.

Reference Books

1. Parikh C.K., Parikh's Textbook of Medical Jurisprudence and Toxicology, Publishers, Bangalore.6th Edition 1999,Reprint 2007.
2. Franklin, C.A Modi's medical Jurisprudence and Toxicology, published by M. Tripathi Private Limited,.21st Edition. Bombay.

3. Keith Simpson, Bernard Knight, 1988, Forensic Medicine, ELBS. 9th Edition
4. Pillay V.V., Text book of Forensic Medicine,2009, Paras Publication. Hyderabad
5. JB Mukherjee's Forensic Medicine and Toxicology – Volume I and II (combined)-edited by Karmakar ,III Edition 2007.
6. Lyon's Medical Jurisprudence & Toxicology ,2004, 11th Edition : Delhi Law House, Delhi
7. Modi's Textbook of Medical Jurisprundence and toxicology- Edited by BV Subramanyam, Butterworths India, New Delhi.22nd edition, 2001.
8. Dr. Krishan Vij- Text book of Forensic Medicine & Toxicology- Principles and Practice, BI Churchill Livingston, New Delhi, 2nd edition, 2002.

15MBC112 MOLECULAR DEVELOPMENTAL BIOLOGY 4 0 0 4

Course objectives

The course integrates the descriptive, experimental and biochemical approaches into a conceptual framework for the analysis of development. The course deals with key steps in the transformation of the single-celled zygote into the complex, multicellular, adult organisms and links genetics with embryology.

Unit 1 Evolution and Fertilization (10)

Introduction, history and evolution – an overview. Development among unicellular eukaryotes *Acetabularis*, *Naegleria*. The origins of sexual reproduction. Fertilization: structure of gametes, recognition of sperm and egg –action at distance and contact of gametes. Cleavage: Patterns of embryonic cleavage, radial holoblastic cleavage, spiral holoblastic cleavage, mechanisms of cleavage –regulation of cleavage cycles.

Unit 2 Model organisms (09)

Major model organisms. Availability/ culture and cost; access and micro-manipulation. Examples: *Drosophila*, zebrafish, *Caenorhabditis elegans, chicks*

Unit 3 Embryonic development in animals (10)

Early Embryonic Development, morphogenesis and organogenesis in animals: Blastula formation, Types of Cleavage, Gastrulation and formation of germ layers in animals. Cell aggregation and differentiation in *Dictyostelium;* axes and pattern formation in *Drosophila,* organogenesis –vulva formation in *Caenorhabditis elegans;* eye lens induction, limb development in vertebrates, neuron differentiation, larval formation, metamorphosis; environmental regulation of normal development.

Unit 4 Early Embryonic Development in plants (09)

Early Embryonic Development in plants: Gametogenesis, Fertilization, Embryo sac development and double fertilization in plants

Unit 5 Regeneration and Apoptosis (10)

Cell death and regeneration. Concept of regeneration; cell cycle, programmed cell death; aging and senescence. Basics of cancer development.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Know about the basic concepts of developmental biology

CO2: Know how fertilization and cleavage occur

CO3: Discern out the process and consequence of gastrulation

CO4: Know about the process of differentiation to many different types of cells and tissues

CO5: Have understanding of the basic concepts of organogenesis

Text Books

1. T. Subramoniam, Molecular developmental biology. 2nd Edition, 2011.
2. Manju Yadav, Molecular Developmental Biology. Discovery Publishing Pvt.Ltd. 2008.
3. Abhilash jain, Advanced developmental biology. 2010.

Reference Books

1. Scott F. Gilbert, Susan Singer, Developmental Biology. Sinauer Associates Inc.; 8th ed, 2006.
2. Jonathan M. W. Slack, Essential Developmental Biology. Wiley-Blackwell. 3rd Edition, 2012.
3. Fred Wilt and Sarah Hake, Principles of Developmental Biology. First edition, 2003.
4. R.M. Twyman, Developmental Biology. First edition, 2001.
5. Lewis Wolpert, Developmental Biology: A Very Short Introduction. Oxford University Press; 1st edition, 2011.

15MBC113 NANOTECHNOLOGY 4 0 0 4

Course objectives

To make students to understand the basics of nano, nanoparticles, nanomaterials, various methods of synthesis of nanoparticles, applications of nanoparticles, Synthesis and characterization of new nanoparticles.

Unit 1 Introduction (10)

Background to Nanotechnology: Scientific revolution- Atomic structures-Molecular and atomic size-Bohr radius – Emergence of Nanotechnology – Challenges in Nanotechnology - Carbon age–New form of carbon (from Graphene sheet to CNT).

Unit 2 Nanostructures and nanomaterials (10)

Definition of a Nano system - Types of Nanocrystals-One Dimensional (1D)-Two Dimensional (2D) -Three Dimensional (3D) nanostructured materials. Carbon Nanotubes (CNT) - Metals (Au, Ag) - Metal oxides (TiO_2, CeO_2, ZnO), Biological system - DNA and RNA - Lipids – Size dependent properties - Mechanical, Physical and Chemical properties.

Unit 3 Synthesis of nanomaterials (9)

Synthesis of bulk nanostructured materials - Sol Gel processing- Mechanical alloying and milling-inert gas condensation technique-bulk and nano composite materials - Grinding - high energy ball milling-types of balls-WC and ZrO_2-materials –ball ratio-limitations- melt quenching and annealing

Unit 4 Characterization of nanomaterials (10)

Characterisation: Spectroscopic techniques - Infra red spectroscopy (IR)- UV-visible-Absorption, Imaging techniques - Diffraction analysis – XRD, Imaging techniques – Scanning Electron Microscope, Transmission Electron Microscope.

Unit 5 Nanomedicine (10)

Nanotechnology for drug discovery - protein and peptide based compounds for cancer and diabetes - drug delivery - nanoparticle based drug delivery - lipid nanoparticles - vaccination - cell therapy -Gene therapy.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Acquire knowledge about basics of nano scale, nano particles and nanomaterials

CO2: Gain expertise in designing experiments and research hypothesis

CO3: Understand the principle and industrial application of nanoparticle

CO4: Understand the mechanism for synthesis of nanoparticles

CO5: Know the principle and operating systems of bio analytical instruments

Text Books

1. S.Shanmugam, Nanotechnology, MJP Publishers, 2010
2. Edited by Jurgen Schulte, Nanotechnology, John Wiley & Sons Ltd., 2010

Reference Books

1. Charles.P.Poole.Jr., Frank.J.Owens, Introduction to Nanotechnology, John Wiley & Sons, Inc., 2009
2. Richard.E.Smalley, Nanotechnology,Jaico publishing house, 2011
3. Richard Booker, Earl Boysen, Nanotechnology, Wiley publishing Inc., 2010
4. Nanosystems, K.Eric Drexler, John Wiley & sons Inc., 2010
5. R.Balasubramaniam, Callister's material science and engineering, Wiley India, 2011

15MBC114 STEM CELL TECHNOLOGY 4 0 0 4

Course objectives

This paper aims to provide thorough information on the basic properties of stem cells and the regulation at molecular level. It also describes the application of stem cell technology in the therapy of different diseases.

Unit 1 Stem cells (09)

Definition, characterization, pluripotency, niche specification – Drosophila germ line stem cells, self renewal and differentiation. Adult versus embryonic stem cells, post genomic adult stem cells, stemness, characteristics, hierarchy, stem cell niche. Adult stem cell from amniotic fluid, cord blood. Isolation and maintenance of murine stem cells, primate embryonic stem cells, human embryonic stem cells.

Unit 2 Embryonic stem cells (10)

Principle of cell passage, colony formation, techniques for derivation of embryonic stem cells, differentiation and transdiffrentiation. Derivation and maintenance of human embryonic stem cells, derivation and differentiation of human embryonic germ cells, isolation and maintenance of avian embryonic stem cells, Xenopus embryonic stem cells, zebrafish embryonic stem cells.

Unit 3 Culture (10)

Trophoblast stem cells – Identification and lineage specificity, isolation and maintenance of neural precursors, primitive hematopoietic cells. GF and serum free culture of stem cells, feeder free culture, genetic manipulation of human embryonic stem cells, gene silencing, RNAi, vector modified transformation on lentivirus. Recombination, homologous recombination.

Unit 4 Properties (10)

Surface antigen markers, lineage markers, microarray, chemical mutagenesis. Hitchhiker effect, gene silencing, epigenetic mechanism, nuclear transfer cloning, parthenogenetic stem cells.

Unit 5 Applications **(10)**

Pluripotency of neural and cloned mouse embryo, genomic reprogramming, immunogenicity of stem cells, tolerance in transplantation. Therapeutic application-neurodegenerative disorders, spinal cord injury, heart diseases, diabetes, tissue engineering.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Know about various stem cells, their characteristics and their niches

CO2: Understand the importance of growth factors

CO3: Understand the basis of media composition for growth of stem cells

CO4: Discern the molecular concepts of stem cell self-renewal and tissue and organ development.

CO5: Demonstrate the routine methods used in stem cell biology.

Text Books

1. Kiessling, A.A. Human Embryonic Stem cells. Jones & Barlett Publishers. 2nd Ed, 2006.

2. Lanza, R . Essentials of Stem Cell Biology. Academic Press. 1st Ed, 2005

References Books

1. Turksen, K. Adult Stem Cells. Humana Press, Inc. 1st Ed, 2004

2. Thomson, J et al. Handbook of Stem Cells: Embryonic/ Adult and Fetal Stem cells (Vol. 1 & 2). Academic Press , 1st Ed, 2004.

3. Institute of Medicine (Corporate author). Stem cells and the future of regenerative medicine. National Academy Press., 1st Ed, 2002.

15MBC115 CANCER BIOCHEMISTRY 4 0 0 4

Course objectives

This curriculum is designed to provide students a broad understanding of the molecular, genetic, cell biological, and pathobiological aspects of cancer. Students will also learn about the current state of clinical diagnosis, treatment of human cancers, and hurdles to overcome to realize its potential.

Unit 1 Cell cycle (10)

Regulation of Cell cycle - Cell cycle control and pRb tumor suppressor. Apoptosis and p53 tumor suppressor. Mutations that cause changes in signal molecules - effects on receptor - signal switches. Tumor suppressor genes.Modulation of cell cycle in cancer. Different forms of cancers. Diet and cancer.

Unit 2 Carcinogenesis (09)

Chemical Carcinogenesis, Metabolism of Carcinogenes is, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, X-Ray radiation – Mechanism of radiation Carcinogenesis. DNA repair mechanisms.

Unit 3 Oncogenes (10)

Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes Oncogenes / Proto Oncogenes activity RAS, NFkB, Wnt signaling in cancer. Epigeneitcs of cancer – DNA methylation, Histone modification, gene silencing by micro RNA.

Unit 4 Metastasis (10)

Clinical significances of invasion, Metastatic cascade Three step theory of invasion, Proteinases and tumour cell invasion. Multi-step tumorigenesis and the evolution of cancer.Tumor-promoting stimuli.Cancer stem cells.

Unit 5 Treatment **(09)**

Different forms of therapy - Chemotherapy, Radiation Therapy, Immunotherapy.Detection of Cancers.Prediction of aggressiveness of Cancer. Advances in Cancer detection

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Have better understanding of terminologies of 'Molecular Biology'

CO2: Have basic understanding of 'Genetics'

CO3: Gain knowledge on cell cycle as well as apoptosis

CO4: Have knowledge about cancer, its development and types

CO5: Have knowledge about genes with reference to cancer formation and mechanism

Text books

1. Vincent.T, Devita, Cancer-Principles & practice of oncology, 3rd edition, 2014.
2. Momna Hejmadi, Introduction to Cancer Biology. 2nd edition.

Reference Books

1. Kinnell Parchment G. Mc. R. E, Perantoni. The Biological Basis of Cancer, Cambridge University Press, 2nd Edition, , 2006
2. Robert A. Weinberg, The Biology of Cancer. Garland Science. 2006.
3. Lauren Pecorino, Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics Oxford University Press; 3 edition, 2012.
4. Raymond W. Ruddon, Cancer Biology. Oxford University Press,2007.

15MBC16 BIOCHEMISTRY OF CELL SIGNALLING 4 0 0 4

Course objectives

The course was designed in such a way to the impart knowledge of signaling mechanisms taking place at cellular level and to assess the mechanism of signaling molecules in transduction process

Unit 1 Membrane Transport (10)

Membrane assembly – importins and exportins. Membrane transport: Diffusion (passive and facilitated). Active transport – symport, antiport, Na+ K+ ATPase. Ion gradients, ion selective channels, group translocations. Endocytosis and exocytosis.

Unit 2 Cell Signaling I (10)

Fundamental concepts and definitions of signal, ligands, and receptors, Endocrine, paracrine and autocrine signaling. Receptors and signaling pathways – cell surface receptors, ion channels, G – protein coupled receptors, receptor kinases (tyr, ser/thr).

Unit 3 Cell Signaling II (09)

Signal transduction through cytoplasmic and nuclear receptors. The Ras – raf – MAP kinase cascade. Second messengers – cyclic nucleotides, lipids and calcium ions. Crosstalk in signaling pathways.

Unit 4 Cell cycle (09)

Cell Cycle: - Overview of cell cycle. Cell cycle Control in mammalian cells, Checkpoints in cell -cycle regulation.

Unit 5 Cancer (10)

Cell cycle and cancer: - Apoptosis (Programmed cell death) -- Pathways, regulators & effectors in apoptosis. Cancer: Properties of tumor cells & Genetic basis and onset of cancer. Tumor suppressor genes and functions of their products. Carcinogenic effect of chemicals and radiation. Molecular diagnosis of cancer.

Total : 48 hours

Course outcomes

CO1: Understand the basics of “Cell Biology”

CO2: Comprehend the historical and current understanding of cell membrane structure and function

CO3: Demonstrate membrane structure and functions

CO4: Demonstrate the types of transport mechanisms on membranes

CO5: Encompass the basic concepts of co-ordination and integration in multicellular organisms with respect to metabolic events

Text Book

1. Lodish et al. Molecular Cell Biology. Scientific 5th ed. Freeman.2003

Reference Books

1. De Robertis and De Robertis. Cell and Molecular Biology, Lea and Febiger. 8th ed. 2006

2.Karp G. Cell and Molecular Biology. 3rd ed. John Wiley and Sons. 2002.

3.Lodish et al. Molecular Cell Biology. Scientific 5th ed. Freeman.2003

4. Twyman. Advanced Molecular Biology. Viva books. 2nd ed. 1998

5. 6. Alberts et al. Molecular Biology of the Cell. 4th ed. Garland Sci. 2002.

7. Murray et al. Harper’s Biochemistry. 26th ed. McGraw Hill. 2003 (for Unit–II).

15 MBC117 ENVIRONMENTAL SCIENCES 4 0 0 4

Course objectives

The core Module Syllabus for Environment Studies includes class room teaching and Field Work. The course structure includes the continuing problems of pollution, loss of forget, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues.

Unit 1 Principles and Concepts of ecosystem (10)

Structure of ecosystem and Homeostasis- Energy transfer in an ecosystem-Food chain. Food web-Ecological efficiencies- Trophic structure and energy pyramids. Biogeochemical cycles(N, C, P cycles). Biodiversity: Types of diversity; Genetic diversity,Species diversity and Ecosystem diversity. Molecular taxonomy –Methods of biodiversity conservation- Gene banks; Cryopreservation. Assessing, analyzing and documenting biodiversity – Vulnerability and extinction of biodiversity.

Unit 2 Properties of water (10)

Water quality parameters- pH, Dissolved Oxygen (DO),Chemical Oxygen demand (COD); Biological Oxygen demand(BOD); Atmospheric toxicants- CO, NO_2, CO_2, SO_2-; Toxic heavy metals. Radionuclides. Sampling of air , soil and water pollutants - Monitoring techniques and methodology; Pesticide residue – classification, degradation, analysis, pollution due to pesticides; phenols and petrochemicals

Unit 3 Traditional Biological treatment (10)

stabilization pond, aerated lagoon, activated sludge process trickling filter anaerobic treatment. Use of microbes (bacteria and fungi) in biodegradation and Biotransformation: Bioremediation. Microbial transformation; Accumulation and concenteration of metals; Biosorption- Oil field microbiology; Improved oil recovery; Biotechnology and oil spills.

Unit 4 Environmental Biotechnology (10)

Biodegradation of agricultural chemicals; GM Crops and their impact on environment; Biofertilizers; Biological control of insect pests; Role of biopesticides/ insecticides; Biocontrol of plant pathogens; Integrated pest management-practical implementation

Unit 5 Role of biotechnology in management of resources (09)

Reclamation of wasteland: Biomass production: Biogas and biofuel production; Development of environment-friendly processes such as integrated waste management. Nature of Environmental Policies; International Agreements and Treaties:Stockholm Conference (1972); Rio Conference (UNCED) (1992); Johnesburg treaty; GAAT and Environment; CITES; Montreal protocol National Policy on Environment, Constitutional provisions for Environmental Protection.

Total : 48 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand complex relationships between natural and human system

CO2: Demonstrate awareness of ecosystem

CO3: Understand the ecological knowledge and its consequences

CO4: Easily assess the environmental changes and challenges

CO5: Understand natural science, how biology, chemistry and physics interlinked

Text Books

1. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R). 2006
2. Agarwal, K.C. Environmental Biology, Nidi Publ. Ltd. Bikaner. 2001

Reference Books

1. Sharma B.K. Environmental Chemistry. Geol Publ. House, Meerut. 2001
2. Jadhav, H & Bhosale, V.M. Environmental Protection and Laws. Himalaya Pub. House, Delhi 1995.

GENERIC ELECTIVES

COMMUNICATIVE ENGLISH I 2 0 0 2

Course objectives

To enable the students to develop their communication skills effectively. To make students familiarize with the English Language, to enrich vocabulary in English and to develop communicative competency

Unit 1 Reading Comprehension and Vocabulary (5)

Filling in the blanks – Cloze exercises – Vocabulary building- Reading and answering questions

Unit 2 Listening and answering questions (5)

Listening and writing – listening and sequencing sentences – filling in the blanks – Listening and answering questions

Unit 3 Group Discussion (5)

Why GD is a part of a selection process – structure of a GD - Strategies in GD – Team work – body language

Unit 4 Conversations (5)

Face to face Conversations & Telephone Conversations.

Unit 5 Self-Introduction and Role Play (4)

Total : 24 hours

Text Books

1.Robert Heller, Communicate Clearly – Dorling Kindersley Ltd., London 1998.

Reference Books

1. Matthukutty M. Monippnally, Business Communication Strategies, Tata McGrawHill, 2001.
2. T.M. Farhatullah, Communication Skills for Technical Students**,** Orient Longman, 2002

3. Deborah Dumame Write to the top – Writing for Corporate Success; Random House, 2004
4. Jayashree Balan, Spoken English, Vijay Nicole Imprints , 2005.

COMMUNICATIVE ENGLISH II 2 0 0 2

Course objectives

To enable the students to develop their communication skills effectively. To make students familiarize with the English Language, to enrich vocabulary in English and to develop communicative competency

Unit 1 Presentation skills (5)

Unit 2 Soft Skills (5)

Time Management, Stress Management and Body Language

Unit 3 Resume/Report/Letter Writing (5)

Unit 4 30 Frequently asked Questions (5)

Unit 5 Interview Skills (4)

Total : 24 hours

Text Books

1. Robert Heller, , Communicate Clearly – Dorling Kindersley Ltd., London 1998.

Reference Books

1. Matthukutty M. Monippnally, Business Communication Strategies, Tata McGrawHill, 2001.
2. T.M. Farhatullah, Communication Skills for Technical Students**,** Orient Longman, 2002
3. Deborah Dumame Write to the top – Writing for Corporate Success; Random House, 2004
4. Jayashree Balan, Spoken English, Vijay Nicole Imprints , 2005.

15MBC153 BIOINFORMATICS 2 0 0 2

Course objectives

The course aims to provide students with a practical and hands-on experience with common bioinformatics tools and databases.

Unit I DNA and Proteins (5)

Nucleic acids: double helix, melting temperatures, closed circular DNA and supercoiling, Open Reading Frames (ORFs), Introduction to Proteins, Protein Structure: Secondary, Tertiary, Quarternary. The notion of Homology as evolutionary relatedness. Similarity and Identity of sequences..

Unit 2 Sequence databases and formats (5)

Primary and secondary databases. Nucleotide sequence databases, nucleotide sequence flat files. Functional divisions in sequence databases. Protein sequence databases: Genpept, Uniprot, Swissprot, PIR. Genbank, FASTA,ASN. Information retrieval for biological databases. The NCBI resource. Entrez, Pubmed, Medline. Entrez Boolean search terms and statements. Locuslink, NCBI bookshelf

Unit 3 General introduction to computers (5)

Organization of computers, computer algorithms.Various devices, memory and application. Computers as a system : Basic concepts, stored programs, functional units, and their interrelation: communications with computer.

Data storage devices primary storage: storage addressed and capacity, types of Memory: Secondary storage devices : Magnetic tape – data representation and R/W: Magnetic disks, fixed and removable, data representation and R/W : Hard disks, Optical disks, CD-ROM, Mass storage devices.

Unit 4 Role of statistics in bioinformatics (5)

Fundamentals of statistics: Data types, collection and representation of data. Mean, median, mode, measures of dispersion. Probability definition, addition and multiplication theorems, Baye's Theorem.

Unit 5 Practicals **(4)**

1. Retrieval of DNA sequences from Entrez databases
2. Retrieval of protein sequences
3. Retrieval of sequences in different sequence formats
4. Searching for publications in Pubmed by different criteria

Total : 24 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Demonstrate practical skills and gains hands on experience in common bioinformatics tools and databases.

CO2: Attain knowledge to interpret the relation among living things and solve biological problems, from the molecular to ecology level using bioinformatics tools.

CO3: Learn the physical, chemical and biological properties of Nucleic acids and proteins as a prerequisite for gene sequencing analysis.

CO4: Learn about primary and secondary databases of nucleic acids and proteins(Swissport, PIR, FASTA, Pubmed, Medline & NCBI).

CO5: Understand the basic concepts of Computer organization, functioning, data storage devices(Primary & Secondary).

Text Books

1. Arthur lesk. Introduction to bioinformatics. 4th edition. 2014. Oxford University press.
2. Jin Xiong. Essential Bioinformatics: 2006. Cambridge University Press.
3. Mount David. Bioinformatics: sequence and genome analysis, 2nd edition. 2000, Cold Spring harbor Laboratory.

Reference Books

1. Stephen Misener, Stephen A. Krawetz. Methods and Protocols (Methods in Molecular Biology) 1999, Humana Press.
2. Jonathan Pevsner. Bioinformatics and Functional Genomics 2nd Edition2009, Wiley Blackwell.

15MBC154 PATHOLOGICAL BASIS OF DISEASES 2 0 0 2

Course objectives

The syllabi of Pathology compliments and supplements the necessary knowledge students have gained in Physiology. Consequently it incorporates topics like cellular adaptations, inflammation, neoplasia, cellular ageing and other infectious diseases. Pathology also provides the necessary inputs for the other disciplines like Pharmacology, social and preventive medicine, medicinal biochemistry etc.

Unit 1 Introduction (5)

History of pathology, Basic definitions and common terms used in pathology, Survival mechanism and disease, microscopic and cellular pathology, scope and techniques used.

Unit 2 Cell Injury and responses of cells: Cellular Adaptations, and Cell Death (5)

An overview of cellular adaptation: Hyperplasia, Hypertrophy, Atrophy, Metaplasia; Causes and mechanisms of cell injury, reversible and irreversible injury, Necrosis, Apoptosis, Types of apoptosis, Intracellular accumulations, Cellular ageing

Unit 3 Role of Inflammation in disease (5)

Basic concepts with suitable examples of general features of acute and chronic inflammation: Vascular Changes, cellular events, important chemical mediators of inflammation, Morphological effects inflammation response, Granulomatus Inflammation.

Unit 4 Role of Tissue repair Healing and Fibrosis (4)

Basic mechanism of tissue regeneration, and repair by healing, scar formation and fibrosis

Unit 5 Common Hemodynamic Disorders in diseases (5)

An overview of Edema, hyperemia, congestion, hemorrhage, hemostasis and thrombosis, Embolism, Infarction and shock with suitable examples

Total : 24 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Attain a thorough knowledge on the cellular adaptations and the response of tissues to neoplasia.

CO2: Understand the pathological changes during cellular ageing and other infectious diseases.

CO3: Provide An insight into the history of pathology covering all the basic definitions and common terms.

CO4: Detail on the survival mechanism in diseases, an insight into microscopic and cellular pathology.

CO5: Elaborate the overview of cellular adaptation including Hyperplasia, Hypertrophy, Atrophy, and Metaplasia.

Text Books

1. Robbins and Cotran. Pathologic Basis of Disease, 8th edition (2009), Vinay Kumar, Abul. K.

Abbas, Jon C. Aster, Nelson Fausto; Saunders Publishers, ISBN-13: 978-1416031215

Reference Books

1. J.,Ed. Underwood and J. C. E. Underwood General And Systematic Pathology, 2nd edition (1996); Churchill Livingstone, ISBN-13: 978-0443052828

2. Ramnik. Sood Medical Laboratory Technology Methods and Interpretations, 6th edition (2009),; Jaypee Brothers Medical Publishers, ISBN-13: 978-8184484496.

15MBC155 MEDICINAL BOTANY 2 0 0 2

Course objectives

The kinds of alternative medicines and the importance of medicinal plants has been well described in this paper.

Unit 1: Indigenous medicinal sciences I (5)

Indigenous Medicinal Sciences; Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments,

Unit 2: Indigenous medicinal sciences II (5)

Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations.

Unit 3: Conservation of endangered and endemic medicinal plant (5)

Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant. Gardens.

Unit 4: Propagation of Medicinal Plants (4)

Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.

Unit 5: Ethnobotany and Folk medicines (5)

Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, blood pressure and skin diseases.

Total : 24 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the basic terminologies and scope of indigenous system of medicine

CO2: Discuss about the preparation and application of plant based drugs.

CO3:Demonstrate the preparation and applications of Ayurveda, Siddha, Unani medicines.

CO4: Explore knowledge on different methods of plant conservation and propogation.

Text Book

1. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.

Reference Book

1. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edition. Agrobios, India.

15MBC156 BIOMATERIALS 2 0 0 2

Course objectives

Biomaterials restore the body of a person back to normalcy following any trauma or disease. The paper comprises of topics which describes the properties, synthesis and application of biomaterials.

Unit 1: Introduction to biomaterials (5)

Classification, Chemistry and characterization of biomaterials. The state of the art of biomaterials and the challenges. Disciplines involved in biomaterials science and the path from a need to a manufactured medical device. Material selection requirements for biomaterials – metals, composites, ceramics and polymers. Tissue environment of the implanted biomaterial: unit cell processes. Tissue responses to implants. Nanomaterials: fullerenes, carbon nanotubes, nanomembranes. Synthesis of bio-materials, Characterization of chemical, physical, mechanical properties, visco elasticity, end group analysis, determination of molecular weight of a polymer.

Unit 2: Biocompatibility (5)

Biocompatibility of Bio-materials, wound-healing process, body response to implants, blood compatibility. Tests to assess biocompatibility of a polymer, modifications to improve biocompatibility. Reactions of biomaterials with cellular and extra cellular components.

Unit 3: Modified biomaterials (4)

Biodegradative biomaterials, Bioactive polymers and biosynthetic polymers, inert biomaterials, genetically engineered biomaterials

Unit 4 : Applications of Biomaterials – 1 (5)

Tissue Replacement Implants, Acute Wound Healing, Blood Clotting, Chronic Wound Healing and Foreign Body Response. Soft-tissue replacements, sutures, surgical tapes, adhesive, percutaneous and skin implants, maxillofacial augmentation, blood interfacing implants, hard tissue replacement implants, internal Fractures fixation devices, joint replacements.

Unit 5: Applications of Biomaterials - 2 **(5)**

Artificial Organs Artificial Heart, Prosthetic cardiac Valves, Limb prosthesis, Externally Powered limb, prosthesis, Dental Implants, Other applications. Liposomes, hydrogels and Nanomaterials in drug delivery. Biomaterials in diagnostics and bioanalytical techniques.

Total : 24 hours

Course outcomes

After the completion of this course, the student will be able to

CO1: Discuss fundamentals of biomaterials with emphasis on classification, chemistry and characteristics

CO2: Elaborate the methods of synthesis of biomaterials

CO3: Identify biomaterials appropriate for given application

CO4: Study the advantages and disadvantages of different biomaterials

CO5: Analyze biocompatibility and tissue-material interaction for different kinds of biomaterials

Text Book

1. Sujata V. Bhat, Biomaterials , 2 nd edition, Narosa Publishing House, New Delhi, 2006.

Reference Books

1. Buddy D. Ratner, B. D. Ratner,Allan S. Hoffman, Biomaterials Science:
An Introduction To Materials In Medicine, 2nd Edition(2004) Publisher: Academic Press.

2.Fred W.Billmeyer, Text book of Polymer Science. 3 rd edition John Wiley and sons publications.